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| 10/788,815 | 02/27/2004 | Gordon Ma | 068736.0230 | 7854 |
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31625 7590 06/30/2005

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| EXAMINER |
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NGUYEN, CUONG QUANG

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| ART UNIT | PAPER NUMBER |
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2811

DATE MAILED: 06/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|---------------------------|--|
| Office Action Summary | Application No. 10/788,815 | Applicant(s) MA ET AL. | |
| | Examiner Cuong Q. Nguyen | Art Unit 2811 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-70 is/are pending in the application.
- 4a) Of the above claim(s) 13-23, 25-35, 37, 39-41, 46, 48-54, 58-60 and 62-70 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12, 24, 36, 38, 42-45, 47, 55-57 and 61 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>02-27-04</u> | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Election/Restriction

1. Applicant's election with traverse of Embodiment I, Fig.2-3D is acknowledged.

The traversal is on the ground(s) that Embodiments have common subject matter as claimed in claim 1 with "different coupling structures". This is not found persuasive because, in detail, these Embodiments with "different coupling structures" are distinct and not obvious to each other. According to MPEP 802.01 that application including claims containing two distinct inventions or more, Applicants have to elect only one of these inventions.

The requirement is still deemed proper and is therefore made FINAL.

It is noted that the limitations of claims 13-23, 25-35, 37, 39-41, 45, 48-49, 51-54, and 58-60 are not in the elected Embodiment 1, so these claims have been withdrawn from consideration.

Specification

2. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The

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abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The term "comprises" should not be used in the Abstract.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 10, 12 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Morikawa et al. (US 6,707,102).

Regarding claim 1, Morikawa et al. discloses A semiconductor device comprising: a semiconductor substrate (1); an insulating layer (11) on top of the substrate; a lateral field effect transistor comprising a drain region (9) and a source region (50) arranged in the substrate and a gate arranged above said substrate within said insulating layer; a drain runner (15) arranged on top of the insulator layer above the drain region; a source runner (*13) arranged on top of the insulator layer above the

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source region; a gate runner (14) arranged on top of the insulator layer outside an area defined by the drain runner and the source runner; a first coupling structure comprising a via for coupling the drain runner with the drain region; and a second coupling structure comprising a via for coupling the source runner with the source region. See Morikawa et al.'s Fig.1 and Fig.2.

Regarding claim 10, as shown in Morikawa et al.'s Fig.2, a sinker structure (6) that reaches from the top to the bottom of the substrate.

Regarding claim 12, as shown in Morikawa et al.'s Fig.2, a well structure (7) surrounding the source region (5).

Regarding claim 24, Morikawa teaches that the substrate comprises a p+ substrate (1A) and a p- epitaxial layer (1B). Col.5 lines 40-50.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 3, 4, 5, 6, 7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morikawa et al. in view of Huang et al. (US 5,654,589).

Regarding claims 2, 4, 7, Morikawa et al. teaches all the limitations of claim 1 as shown above. However, Morikawa et al. does not teach that metal layers arranged at the bottom of via.

Huang et al. discloses a semiconductor device comprising metal layers including a Ti layer (28) and a TiN layer (30) formed at a bottom of a via and having a cross-sectional profile of a saucer around the via. See Huang et al.'s Fig.2.

It would have been obvious to one of ordinary skill in the art to incorporate the metal layers as taught by Huang et al. into Morikawa et al.'s device in order to increase alignment tolerances and to reduce the contact resistance. See Huang et al.'s col.5 lines 15-24 and 54-65.

It is noted that the stack of metal layers of Ti/TiN which the same material for forming barrier metal layers in the present invention. So, the metal layers inherently function as barrier layers as claimed.

Regarding claim 3, Morikawa teaches the source, drain runners and the coupling structures are formed from the same layer. Morikawa does not teach that the runners and the coupling structures are formed by using different layers such that the contact holes are completely embedded with electrical conductive layer.

Huang et al. teaches that forming the electrical conductive layer and the

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first-layer metal line layer by using two layers such as filling the contact hole the using CMP to be flattened and then forming a second metal layer on the electrical conductive layer. See Huang's Fig.2.

It would have been obvious to one of ordinary skill in the art to form the source/drain runner and the coupling structure by using different layers such that the contact holes are completely embedded with electrical conductive layer as taught by Huang et al. in order to obtain a planar upper surface so that is is easier to form other layers on the planar surface at later steps.

As shown in Haung et al.'s Fig.2, the second metal layer on top of the planar top surface of the via includes a barrier layer (44) (a Ti layer). So the device being formed by the combination of Morikawa et al. and Huang et al. includes barrier layers arranged at the top of via.

Regarding claim 9, Huang teaches that the first metal (40) embedded in the contact hole (via) is formed of tungsten. Col.7 lines 30-35.

Regarding claims 5, 6, as shown in Huang et al.'s Fig.2, the bottom metal layers comprises side wall that enclose the via and space apart from the via.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morikawa et al. in view of Huang et al. and further in view of Callegari et al. (US 6,664,186).

The combination of Morikawa and Huang teaches all the limitation of claim 3 as shown above but does not teach that the top barrier layer consists of Titanium-platinum.

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It is conventional and also taught by Callegari et al. (layer 32 of Fig.27 and column 14 lines 5-15) that TiPt and Ti are art recognized materials for forming barrier layer and they are interchangeable.

It would have been obvious to one of ordinary skill in the art to form the top barrier layer by conventional material TiPt as taught by Callegari et al. instead of Ti.

Claims 11, 42, 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morikawa et al. in view of Rumennik (US 6,600,182).

Morikawa et al. teaches all the limitations of claim 1 as shown above and further teaches that a source electrode (30) formed at back side of the substrate (col.6 lines 45-48). However, Morikawa et al. does not explicitly teach that metal layer arranged at the bottom of via to form the source electrode.

It is conventional and also taught by Rumennik that metal is art recognized material for forming the backside source electrode. See Rumennik's Fig.1 and Fig.2.

It would have been obvious to one of ordinary skill in the art to form the metal layer as the backside source electrode as taught by Rumennik in order to have good connection (metal has a low resistivity) in the future connection with a package electrode. See Rumennik's col.4 lines 15-25.

Claims 36, 38, 43, 44, 45, 47, 50, 55, 56, and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morikawa et al. in view of Huang et al. and further in view of Rumennik (US 6,600,182).

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The combination of Morikawa et al. and Huang et al. teaches all the limitations of claims 2, 3, 4, 5, 6, 7, and 9 as shown above and further teaches that a source electrode (30) formed at back side of the substrate (col.6 lines 45-48). However, Morikawa et al. does not explicitly teach that metal layer arranged at the bottom of via to form the source electrode.

It is conventional and also taught by Rumennik that metal is art recognized material for forming the backside source electrode. See Rumennik's Fig.1 and Fig.2.

It would have been obvious to one of ordinary skill in the art to form the metal layer as the backside source electrode as taught by Rumennik in order to have good connection (metal has a low resistivity) in the future connection with a package electrode. See Rumennik's col.4 lines 15-25.

Conclusion

3. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 872-9306. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

4. Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to CUONG Q NGUYEN whose telephone number is

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(571) 272-1661. The Examiner is in the Office generally between the hours of 6:30 AM to 5:00 PM (Eastern Standard Time) Monday through Thursday.

5. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Eddie Lee who can be reached on (571) 272-1732.

6. Any inquiry of a general nature or relating to the status of this application should be directed to the Technology Center Receptionists whose telephone number is 308-0956.



Cuong Nguyen

Primary examiner

6/16/05